The author points out that "the abortion of certain members of a brood or group to the favour of others" is a phenomenon of frequent occurrence in nature, and he instances those flowers which produce more ovules than ever ripen into seed. According to his theory, the expulsion of the polar bodies is simply an incident recalling the past history of the race, and the physiological explanations are uncalled for. On this view the remarkable constancy of the phenomenon among the higher animals seems to be insufficiently accounted for, while the reduction processes remain imperfectly explained.

In the second chapter the author deals with the problem of heredity, and comes to the conclusion that at present the facts can only be elucidated by the light of mental, not material, processes. While inclining to the memory theories of Butler and Hering, he expresses himself also as favourable to an explanation assuming the succession of a series of complex chemical changes after the manner postulated by Delage or by J. T. Cunningham in his hormone theory of heredity. In the third chapter the author returns to the subject of brood formation and its relation to ordinary cell-division, and the various types of brood formation are briefly described. Chapter iv. first appeared under the title, "The Dual Force of the Dividing Cell," but in this work it has undergone much revision, and is headed "The New Force, Mitokinetism." In addition to the existence of a well-known physical force, and others the physical interpretation of which is uncertain (such as protoplasmic streaming), the author invokes the aid of a new force which he calls "Mitokinetism," besides assuming the existence of further forces which have no clear analogies either in physics or in biology. The whole chapter, though ingenious, is highly speculative, and consequently difficult to criticise in a short review.

In chapter v. Prof. Hartog returns to the subject of nuclear reduction, which is already touched upon in chapter iii. His view may be summarised in the statement that the process is a necessary consequence of cell fusion, instead of a preparation for it. The author appears to us to lay altogether undue stress upon the difference between the two theories. He points out that a reduction must take place somewhere, otherwise the number of chromosomes would go on increasing in geometrical progression. This is, of course, obvious, and since the reduction usually (though not invariably) takes place in the last division of gametogenesis, it appears to us legitimate to regard it as a preparation for zygotic union.

In the next chapter Prof. Hartog reverts to his views on fertilisation. He suggests that owing to the ambiguity of the term "fertilisation" it had better be replaced by "syngamy" when used in its strict morphological sense as the fusion of two cells or nuclei. He makes the interesting suggestion that the formation of the fertilisation membrane is the last relic of the time when the newly-formed zygote usually went into a resting condition.

In chapter vii. the author again gives the arguments in favour of the theory that acquired characters can be inherited, and in chapter vii. the case against a purely mechanistic interpretation of life is once more stated. Great stress is laid on the vital powers of readjustment and compensation under diverse conditions, and the possession of a spontaneity which is never possessed by machines, since these work for the mechanician, whereas the living organism works and adapts itself to its own racial needs.

The chapter on the biological writings of Samuel Butler is well worthy of perusal, and we feel indebted to Prof. Hartog for giving us a further insight into the fascinating personality of the author of "Erewhon." The last two chapters deal with education problems, and though not without interest, seem rather out of place in the present book. Though containing little that is new, the volume supplies a useful summary of the author's views on many subjects, and as such it forms a welcome addition to the "Progressive Science Series." FRANCIS H. A. MARSHALL.

FOUR ZOOLOGICAL TEXT-BOOKS.

(1) *Elementary Biology: Animal and Human.* By J. E. Peabody and A. E. Hunt. Pp. xiv+212. New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 4*s.* 6*d.* net.

(2) *An Introduction to Zoology.* With Directions for Practical Work. (Invertebrates.) By Rosalie Lulham. With Illustrations by V. G. Sheffield. Pp. xv+457. (London: Macmillan and Co., Ltd., 1913.) Price 7*s.* 6*d.* net.

(3) *Teachers' Manual of Biology.* By Prof. M. A. Bigelow. Pp. ix+113. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 1*s.* 8*d.* net.

(4) *A Manual of Zoology.* By Prof. R. Hertwig. Third American from the ninth German edition. Translated and edited by Prof. J. S. Kingsley. Pp. xii+606. (New York: Henry Holt and Co., 1912.)

(1) THE lively book by Messrs. Peabody and Hunt strikes a modern educational note, for the primary emphasis is placed on *practical values.* It is intended as a guide to school-

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teachers. Animals are discussed in order to throw light on the biology of human life, in order to help towards healthy living. Everyday functions get a prominent place; bees, mosquitoes, and flies come to the front; the discussion of birds and fishes leads on to the question of their conservation; the Protozoa are used to illumine man's cellular processes; bacteria receive much attention. Precise practical work is, of course, insisted on as a discipline, and many of the conventional tasks are included. But there are as many which have a fresh practical turn.

The lessons on everyday hygiene, on foods, and on the use of alcohol and tobacco seem to us very sound, and, in short, what we like about the whole book is its persistent endeavour to bring the biological instruction into direct touch with human life. There is no risk that the study of pure science will be in this way endangered, and there is every likelihood that the education of the young citizen will be immensely improved. The book is generously provided with interesting illustrations, many of them photographs.

For future editions we would make the suggestion that the authors do not attempt to cover quite so much ground. Thus the paragraph on the relatives of the earthworm would be much better deleted unless more can be said, and there are many other cases where this book would be improved by recognising the necessity for others. We should like to express our appreciation of the wholesome view that "no study of human biology should be allowed to leave in the mind of the student the idea that he is merely a chemical engine adapted only for the generation of a certain amount of physical energy."

(2) Miss Lulham is to be congratulated on the success of her "Introduction to Zoology," which fills a distinct gap. It introduces the student to the study of living creatures (Invertebrates only) with habits and habitats and interrelations, and it has been written from experience. It abounds in valuable practical hints. There is a convincing reality about the book, and a real feeling of the open air, two qualities which are enhanced by the unusually skilful and spirited figures which have been prepared by Miss Violet Sheffield. This introduction should be of great value to teachers of nature-study, to students working alone, and to those who wish to supplement their more analytic and anatomical work by some sound œcology.

Miss Lulham deals excellently with earthworm and starfish, pond-snail and prawn, but she is at her best when she comes to spiders and insects—to which much more than half the book is devoted. It will be a good thing for the study of natural history if this exceedingly educative "Introduction to Zoology" comes into widespread use, as it certainly ought to do. For it is unusually true to its excellent motto:—

Ἐν πᾶσι γὰρ τοῖς φυσικοῖς ἔνεστί τι θαυμαστόν.

(3) Prof. Bigelow's manual is really a sort of teacher's appendix to accompany "Applied Biology" and "Introduction to Biology," by Anna N. Bigelow and himself. He gives useful hints as to the best way of using the "Applied Biology" (without which this manual is of relatively little use), and advice in regard to material for practical work, methods, equipment, and literature. The orientation of the biological studies in relation to human life is a prominent feature in Prof. Bigelow's plan of instruction, and he is emphatic in regard to the indispensableness of the biological foundation. In regard to sex-hygiene, for instance, he says: "The most practicable step now possible in the world-wide movement for sex-education is the development of the full possibilities of the biological studies that touch the problems of reproduction."

(4) Prof. R. Hertwig's "Zoology" has passed through nine German editions and continues to be a favourite manual. It gives a general introduction to morphology and physiology and a systematic treatment of the various phyla, with special attention to particular types. Its virtues are general trustworthiness, clearness, and a judicious selection of essentials. Its deliberate defects are that it is too much pemmican and not very interesting, and that it says very little about the life of animals. Prof. Kingsley has prepared a revised American edition, especially adapted for American needs. It is to a considerable extent a new book, and it is a competent piece of work sure to be of great utility. It has been very carefully edited, and it includes not a few original figures. We cannot profess, however, to have any belief in the usefulness of the summaries of important facts given at the end of each phylum; many of the propositions are too terse to be true, and altogether they smack of the cram-book.

J. A. T.

OUR BOOKSHELF.

Ueber einfache Pflanzenbasen und ihre Beziehungen zum Aufbau der Eiweissstoffe und Lecithine. By Dr. G. Trier. Pp. iv+117. (Berlin: Gebrüder Borntraeger, 1912.) Price 5·60 marks.

THIS work is a valuable contribution to plant chemistry by a well-known worker who, by his own researches, has considerably enlarged our knowledge in this special domain. He has found it possible to give a summary of recent work and theoretical views of a complex character which is extremely interesting but might easily have

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